April 4, 2007

MEMORANDUM

To: Mark Mason, P.E.
Engineering Manager, Boise Regional Office

From: Steve M. Ogle, P.E.
Boise Regional Office

Subject: Staff Analysis for Draft Wastewater Reuse Permit No. LA-000054-03
Darling International, Inc., Kuna

1. PURPOSE

The purpose of this memorandum is to satisfy the requirements of the *Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater*, IDAPA 58.01.17.400, for issuing wastewater reuse permits (WRPs). This memorandum addresses WRP No. LA-000054-03, for the animal byproducts recycling facility operated by Darling International, Inc. (Darling), located in Kuna, Idaho.

2. SUMMARY OF EVENTS

Wastewater from Darling's Kuna facility is currently land-applied under the terms and conditions of Wastewater Land Application Permit (WLAP) No. LA-000054-02, dated September 24, 1999. This permit was set to expire on September 9, 2004; however, Darling has submitted a permit renewal application package and generally continues to operate the land application system under the terms of the 1999 permit.

A pre-application meeting between representatives from Darling and DEQ was held on April 12, 2004, and Darling subsequently submitted a permit renewal package that was dated April 26, 2004. In response to the permit renewal application, DEQ issued an information request to Darling on April 18, 2005. Darling submitted a response package to DEQ's information request on July 8, 2005. DEQ issued a letter requesting an updated site map to Darling on March 22, 2006. The updated site map was received on April 20, and subsequently approved via email on April 21, 2006.

The 2005 response package from Darling, the April 2004 permit renewal application, and supplemental information from DEQ's internal source files were used to develop the renewal permit for Darling's Kuna facility.

3. PROCESS DESCRIPTION AND SITE DISCUSSION

This section details the nature of the facility and presents relevant characterization information about the wastewater land application system. A site map depicting the physical features discussed in this section of the staff analysis is in contained within Appendix 2 of the renewal permit.

3.1 Process Description

Darling operates an animal byproduct recycling facility in Kuna, Idaho. The wastewater generated at this facility comes from three main sources: 1) wash water (e.g., used to clean processing equipment, floors, etc.),

2) byproduct water generated from the cooking process, and 3) entrainment water from the air scrubbers used to control atmospheric releases. The facility also generates brine wastewaters; however, this effluent stream is managed separately from other wastewater streams (i.e, brine water is retained/evaporated in Brine Pond No. 3). After generation, the three primary wastewater streams are collected and routed through a mechanical skimmer to remove oils, grease, and other large solids. Skimmer effluent is then pumped from a lift station to the secondary treatment system, which consists of two anaerobic lagoons in series (Lagoon Nos. 1 and 2), followed by an aerated lagoon (Lagoon No. 3) used to reduce the biological oxygen demand (BOD) of the wastewater. Treated wastewater is then held in one of two lagoons (Lagoon Nos. 4 and 5). As needed, the treated wastewater is routed from the holding lagoons to the pumphouse located immediately south of Field 1, where it is mixed with irrigation water prior to final land-application treatment. Irrigation water is taken from a dedicated irrigation well located immediately outside of the pumphouse, directly to the east. Wastewater and/or irrigation water can be land-applied via the wheel line system on Field 1 or the center pivot distribution system on Field 2.

3.2 Wastewater Evaluation

The following tables show historical volumes of wastewater and supplemental irrigation water land applied by the facility.

Table 3.1: Wastewater Land Applied at Darling's Kuna Facility

Year	Total Volume of Land Applied Wastewater (MG)	Field 1		Field 2	
		Total Volume Applied (MG)	Volume per Area Applied (inches/acre)	Total Volume Applied (MG)	Volume per Area Applied (inches/acre)
2000	5.3	1.7	3.6	3.5	3.3
2001	4.3	1.5	3.4	2.8	2.6
2002	5.4	2.0	4.6	3.4	3.7
2003	2.1	0.7	1.6	1.4	1.3
2004	2.4	0.8	1.8	1.6	1.5
2005	2.7	0.4	1.0	2.3	2.1

Table 3.2: Supplemental Irrigation Water Applied at Darling's Kuna Facility

Year	Total Volume of Irrigation Water Applied (MG)	Field 1		Field 2	
		Total Volume Applied (MG)	Volume per Area Applied (inches/acre)	Total Volume Applied (MG)	Volume per Area Applied (inches/acre)
2002	53.6	18.9	43.5	34.7	32.0
2003	37.4	12.5	28.8	24.9	23.0
2004	63.1	20.8	48.0	42.3	38.9
2005	43.0	14.6	33.6	28.4	26.1

As shown in Table 3.1, there is a marked decrease in the total, annual amount of wastewater that was land applied beginning in 2003. DEQ made an inquiry into the reason for this decrease in a letter dated April 18, 2005, and, in a reply letter dated July 8, 2005, Darling indicated that historical spreadsheet errors have created this discrepancy and that the more recent data is correct. The precise nature of the spreadsheet error, and consequently the exact volume of wastewater land that was land applied up until 2003, remains unclear at the present time.

Table 3.3 shows annual, average loading rates for wastewater constituents that were land applied by the facility. The values presented in this table were calculated by DEQ, based on monitoring data from annual reports submitted by Darling, and are largely intended for contextual discussion purposes.

Table 3.3: Wastewater Constituent Loading Parameters for Darling's Kuna Facility

Year	Average Annual Constituent Loading Rates			
	Nitrogen (lb/acre/yr)	Chemical Oxygen Demand (lb/acre/day)	Non-Volatile Dissolved Solids[a] (lb/acre/yr)	Phosphorus (lb/acre/yr)
2002	784	9.5	1624	77
2003	281	2.9	599	20
2004	215	2.9	578	13
2005	252	2.9	519	12

[a]Non-volatile dissolved solids loading rates were estimated by subtracting the average annual TDS loading rate from the average annual volatile dissolved solids loading rates and dividing by the total acreage used for land application each year. All information is based on data submitted in annual reports from Darling.

As was seen in a previous table, there is a marked decrease in the average, annual constituent loading rates beginning in 2003. DEQ notes that quantification of constituent loading rate estimates relies on volumetric wastewater loading rates; therefore, the decreased loading rate trend seen in Table 3.3 is likely a function of the same spreadsheet error discussed previously. For purposes of the renewal permit, permit conditions and rate limits related to wastewater volume and quality are generally based upon the parameters reported since 2003.

3.3 Wastewater Treatment Lagoons Evaluation

As part of the permit renewal process, DEQ conducted a year-to-year water balance around the lagoon system. This analysis was conducted in an effort to clarify and/or further assess uncertainties regarding the facility's proposed wastewater generation rate (i.e., 16 million gallons per year) and actual, historic wastewater-land application rates. Darling has only land applied an average of 2.4 million gallons of wastewater for each of the past three years; considerably less than the projected 16 million gallon, annual wastewater generation rate. The facility has only been required to meter the total amount of wastewater taken from the treatment lagoon system for land application; therefore, DEQ has no record of wastewater generation rates at the processing facility or wastewater storage volumes within the lagoon system. For example, some wastewater generated in a given calendar year could be retained within the lagoons throughout the corresponding growing season for that year, and would not be reflected within the total, reported volume of wastewater that was *land applied* for that growing season. Similarly, evaporative and percolate losses from the lagoon system are not accounted within the wastewater land application rates.

The lagoon system has a total reported holding capacity of 14.22 million gallons. Inputs to the lagoon system include 1) wastewater generated at the facility and 2) precipitation that falls into the lagoons. Although the facility is not required to monitor or report its wastewater generation rate (i.e., this parameter is an unknown variable), historical precipitation rates for the area are available from the U.S. Bureau of Reclamation website (i.e., http://www.usbr.gov/pn/agrimet). Outputs from the lagoon system include 1) wastewater that is land applied by the facility, 2) evaporative losses, and 3) percolate losses. Wastewater land application rates are a required monitoring/reporting provision of the facility's existing permit, and the annual free water surface evaporation rate for this area is approximately 40 inches per year (i.e., refer to page IV-76-6 of the *Handbook for Land Application of Municipal and Industrial Wastewater*, DEQ 1996). As part of their permit renewal application, Darling conducted seepage rate testing on each of the lagoons, which allows quantification of percolation losses. Note that the seepage tests were approved by DEQ in a letter to Darling, dated December 30, 2004. DEQ applied these parameters in a simple water balance (i.e., lagoon input equals lagoon output) for years 2002 through 2005, to assess the projected, annual wastewater influent rate to the lagoon system. Table 3.4 shows the input and output variables and the results of the water balance.

Table 3.4: Water Balance for Lagoon System at Darling's Kuna Facility

Year	Input	Outputs			Estimated Influent to Lagoons (MG)
	Precipitation Gains (MG)	Land Applied (MG)	Evaporative Losses (MG)	Percolate Losses (MG)	
2002	2.2	5.4	9.4	3.3	15.9
2003	2.9	2.1	9.4	3.3	11.9
2004	3.3	2.4	9.4	3.3	11.8
2005	3.1	2.7	9.4	3.3	12.3

The spreadsheet error discussed in the previous section of this document (i.e., annual, land applied wastewater volumes reported prior to 2003) is also evident in the data shown in Table 3.4. The higher volume of land applied wastewater reported in 2002 causes a corresponding increase in the estimated volume of influent to the lagoons for that year. This operating year appears to be the basis for Darling's wastewater generation estimate of 16 million gallons per year; however, DEQ notes that the average annual influent rate to the lagoon system estimated for years 2003 through 2005 is actually around 12 million gallons per year. Consequently, there is some uncertainty regarding the potential wastewater generation rate for this facility at the present time. Although Darling has asserted that the data reported after 2002 is correct, the facility has used data from 2002 to derive a potential wastewater generation rate.

To rectify this situation, it is recommended that Darling be required to monitor wastewater influent to the lagoon for the next permit cycle. This data could be used to assess the facility's potential wastewater generation rate, and will also assure that all reported flowrates are correct and verifiable (i.e., refer to Section 4.2.1 of this document for further discussion).

3.4 Soils Evaluation

Field 1 is an 18-acre site that was used to treat all wastewater generated by the facility up through the 1998 growing season. In September of 1999, Darling obtained a permit to expand wastewater-land application operations onto a 40-acre plot owned by the facility. This expansion site is commonly referred to as Field 2. Soils on both sites consist of Colthorp, Power, and Purdam silt loams 20 to 40 inches deep, underlain by basalt.

A review of historic monitoring data for this facility indicates that the original site (i.e., Field 1) was routinely overloaded prior to implementation of land application operations on Field 2. The expansion project appears to have reduced the impact of the facility's wastewater-land application operations on the original site, although Field 1 still shows some evidence of historical over-application (i.e., the most recent soil phosphorus data for this site indicate that concentrations of this constituent remain elevated). Tables 3.5 through 3.7 show historical monitoring data for selected soil parameters on each site.

Table 3.5: Soil Nitrate Data for Darling's Kuna Facility

Year	Field 1 (ppm)			Field 2 (ppm)		
	0-12 inches	12-24 inches	24-36 inches	0-12 inches	12-24 inches	24-36 inches
2002	40.6	53.5	91.5	20.9	28.5	25.7
2003	34.5	16.8	31.2	44.5	18.8	20.7
2004	6.2	6.1	3.2	70.0	49.0	51.0
2005	2.9	4.2	2.0	72.0	51.0	49.0

Table 3.6: Soil Phosphorus[a] Data for Darling's Kuna Facility

Year	Field 1 (ppm)			Field 2 (ppm)		
	0-12 inches	12-24 inches	24-36 inches	0-12 inches	12-24 inches	24-36 inches
2003	70.1	105.0	72.4	10.9	6.9	5.9
2004	23.4	26.0	14.2	7.0	<5.0	8.4
2005	87	45	46	23.0	5.2	6.6

[a]Expressed as plant-available phosphorus. This parameter was reported as total phosphorus prior to 2003.

Table 3.7: Sodium Absorption Ratio Data for Darling's Kuna Facility

Year	Field 1			Field 2		
	0-12 inches	12-24 inches	24-36 inches	0-12 inches	12-24 inches	24-36 inches
2002	6.37	13.60	15.70	6.28	8.74	6.34
2003	2.41	8.22	11.30	3.50	7.67	9.31
2004	5.75	3.62	11.30	6.73	10.80	9.46
2005	2.34	3.64	4.74	5.58	11.3	8.29

As shown in Table 3.5, the soil nitrate concentrations on Field 2 have increased sharply from 2002 to 2005. Significant increases in nitrate concentrations appear throughout the entire profile of the site, and represent a concern to ground water quality, as nitrate can leach into ground water. Section 3.5 of this document addresses current ground water nitrate concentrations, and Section 4.1.8 further discusses current soil nitrate concentrations and the nitrogen-loading rate limit contained in the permit.

The elevated sodium absorption ratios (SAR) reported for Field 2 in recent years is also an issue of concern, because excessive sodium in soils can reduce crop yields and cause soil structure issues that will impede the soil's ability to infiltrate water. DEQ's current guidance indicates that some adverse crop impacts may result when soils have SAR values greater than 10. An increasing trend in the SAR data is readily apparent on Field 2, with current SAR values approaching or exceeding 10 at lower soil depths.

3.5 Ground Water Evaluation

It is generally thought that the ground water flow in this area is to the southeast, and depth to ground water typically ranges from 240 to 280 feet below the ground surface. Localized ground water quality is currently monitored by use of two down gradient wells, GW-005401 and GW-005402, and a single up gradient well, GW-005404. Monitoring Well GW-005401 is located directly to the southeast of Field 1 (i.e., inside of the pumphouse), while GW-005402 and GW-005404 are located to the southeast and northwest of Field 2, respectively. It should be noted that Monitoring Well GW-005401 also serves as the plant production and domestic supply well. Well logs indicate that the three monitoring wells are screened in 30-foot intervals near the bottom of each well, with screened sections extending roughly 20 feet below the water table elevation detected at each well during construction.

Ground water samples from the monitoring wells indicate that elevated concentrations of total dissolved solids (TDS) are present at this site. The ground water data collected between 1997 and 2005 ranges from 356 to 614 milligrams of TDS per liter (mg/L), and includes several exceedences of the TDS standard (i.e., 500 mg/L) contained in the Ground Water Quality Rule (GWQR). The reported TDS concentrations fluctuate somewhat over this time period, but generally appear to have increased slightly over time. DEQ notes that high TDS concentrations have been documented in both up and down gradient monitoring wells for this site, which may be indicative of other sources of TDS in the area; however, data collected to date appears to indicate that the facility's wastewater application operations are contributing to TDS increases in the immediate area. Figure 3.1 presents the reported ground water TDS concentrations plotted over time.

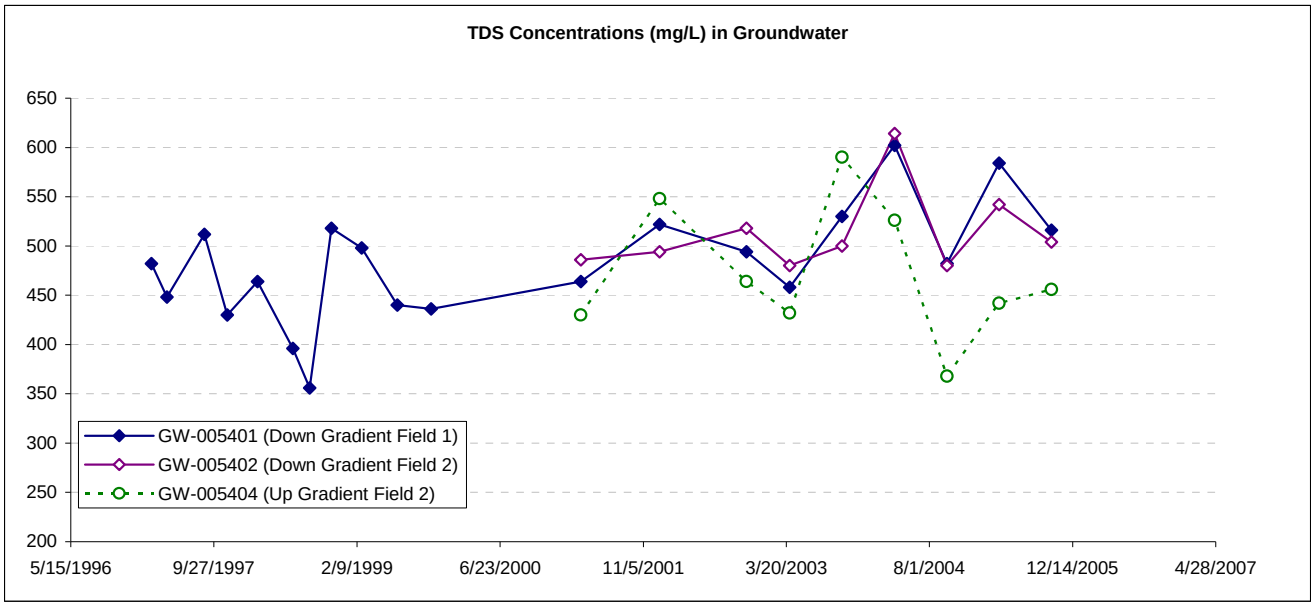

Figure 3.1: Ground Water Monitoring Data for TDS at Darling's Kuna Facility

In response to a compliance activity requirement of the previous permit, Darling developed and submitted a TDS Reduction Plan; however, this plan was largely qualitative in nature and is generally limited to descriptive narratives of potential mechanisms and/or procedures that could be used to reduce TDS concentrations in wastewater effluent. The plan did not address TDS impacts to ground water, nor did it propose TDS loading rates that would be protective of ground water.

In an effort to evaluate the potential for Darling's land application operations to impact ground water TDS concentrations, DEQ used reported crop ash removal rates to approximate TDS removal rates by the crops grown onsite each year. These annual TDS removal rate estimates are presented in Table 3.8.

Table 3.8: Estimated Annual TDS Crop Uptake Rates for Darling's Kuna Facility

Year	Field 1 (lb/acre/yr)	Field 2 (lb/acre/yr)
2002	906.3	1118.4[a]
2003	1089.9	577.3
2004	1111.1	720.4
2005	1261.8	851.0

[a]Wheat was grown on Field 2 in 2002, and resulted in a substantially higher crop yield (i.e., as well as an increased TDS removal rate) than the alfalfa crops subsequently grown on this site.

When comparing the TDS uptake rates in Table 3.8 with the non-volatile dissolved solids (NVDS) loading rates given in Table 3.3, it appears that the TDS uptake from crops is greater than the application rate from the wastewater applied. Consequently, the facility's current wastewater land application rates are not expected to adversely impact ground water quality.

Nitrate concentrations reported in the ground water samples have increased slightly over time, but generally range from 5 to 6 mg/L. The relevant GWQR standard for nitrate is 10 mg/L. Figure 3.2 presents the reported ground water nitrate concentrations plotted over time.

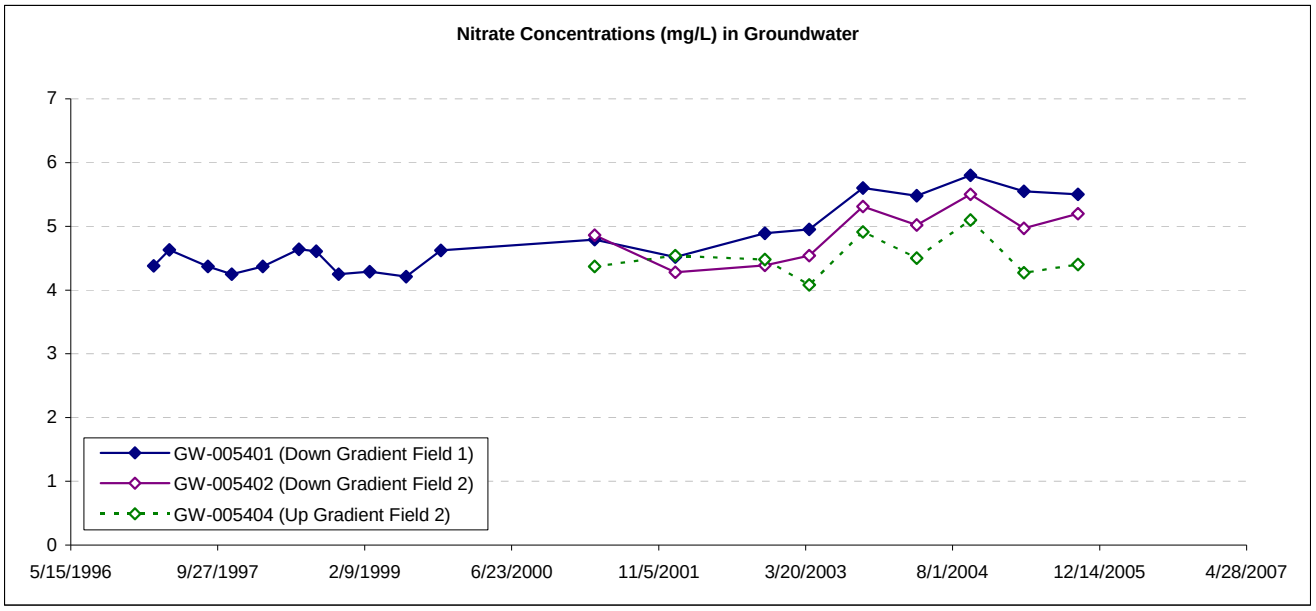

Figure 3.2: Ground Water Monitoring Data for Nitrate Concentrations at Darling's Kuna Facility

At the present time, it does not appear that ground water nitrate concentrations are excessive; however, elevated nitrate soil concentrations have been reported on Field 2 in recent years, which may influence ground water nitrate concentrations. Refer to the previous section of this document for a discussion of soil nitrate levels.

3.6 Miscellaneous Site Issues

Other notable issues associated with this facility include potential pathogenic concerns, nuisance odor concerns, and management of waste solids dredged from the treatment lagoons and generated from truck washout events. Each of these issues has been addressed within the regulatory framework of the renewal permit, and will be discussed in the next section of this document.

4. REGULATORY DISCUSSION

This section discusses regulatory and technical bases for terms and conditions within the draft version of WRP No. LA-000054-03. It also identifies relevant changes that have been implemented within the permit (i.e., changes to permit conditions in WLAP No. LA-000054-02). Administrative changes and/or similar, non-technical aspects of the draft permit (e.g., Sections A-D, I, and J of the permit) are not specifically addressed within this document.

4.1 Site-Specific Permit Conditions – Section E

4.1.1 Growing Season Hydraulic Loading Rate

Current WRP guidance (i.e., *Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater, December 2005*), typically specifies that the growing season (GS) hydraulic loading rate (HLR) should *substantially approximate* the irrigation water requirement (IWR) for crop(s) grown on each HMU. The previous permit for this facility was issued prior to current guidance and did not explicitly establish a GS HLR, but rather, contains a total, annual wastewater loading rate and restricts all wastewater application to the GS timeframe (i.e., April 1 through October 31 of each year). Thus, the existing permit limit only restricts *wastewater* loading rates, and does not establish an overall *hydraulic* loading rate for the facility.

In an effort to update Darling's permit, Section E of the renewed WRP specifies the IWR as the GS hydraulic loading rate applicable to each HMU used for wastewater land application. The IWR is not explicitly specified as a hydraulic loading *limit* for each HMU, but rather, is given as the appropriate hydraulic loading rate that is routinely expected in acceptable cropping operations. This distinction is intended to allow some flexibility needed for proper crop management of the land application sites.

Section C of the renewal permit defines IWR as "[a]ny combination of wastewater and supplemental irrigation water applied at rates commensurate to the moisture requirements of the crop, and calculated monthly during the growing season. Calculation methodology for the IWR can be found at the following website: http://www.kimberly.uidaho.edu/water/appndxet/index.shtml. The equation used to calculate the IWR at this website is:

$$IWR = (CU - Pe) / Ei$$

Where: CU is the monthly consumptive use for a given crop in a given climatic area. CU is synonymous with crop evapotranspiration;

Pe is the effective precipitation. CU minus Pe is synonymous with the mean net irrigation requirement (IR);

Ei is the irrigation system efficiency. To obtain the gross irrigation water requirement (IWR), divide the IR by the irrigation system efficiency."

The 2004 application materials indicate that the facility has a capacity to generate 16 million gallons of wastewater annually. The mean net irrigation requirements for alfalfa hay at the Boise airport and Swan Falls damn locations is 35.4 and 38.9 inches per GS, respectively (i.e., refer to the University of Idaho website). Applying these values for Darling's sites, with an assumed an irrigation efficiency of 80%, results in an IWR of 44.3 and 48.6 inches, respectively. As was shown in Table 3.1, the wastewater applied each GS ranges from 1.0 to 4.6 inches per year; therefore, considerable supplemental irrigation water will be required to maintain crops. Consequently, updating the facility's permit by specifying the IWR as a GS HLR should not result in any compliance issues at current or proposed wastewater generation rates.

Hydraulic application rates to each HMU should generally follow the IWR for crop(s) grown throughout the season. It should be noted that any significant deviation from the IWR during the growing season should be addressed and explained within the narrative interpretation of the subsequent Annual Report submitted for that season (i.e., refer to Reporting Requirement No. 1 in Section H of the renewal permit).

4.1.2 Non-Growing Season Maximum Hydraulic Loading Rate Limit

This facility is not currently permitted to land-apply wastewater in the non-growing season (NGS). During the NGS, the facility stores wastewater within the wastewater treatment and storage lagoons (i.e., Lagoon Nos. 1 through 5). Collectively, these lagoons have a total storage capacity of 14.22 million gallons. The 2004 application materials submitted by Darling indicate that "16.0 million gallons of wastewater is generated annually with no seasonal variation in gallons per day…"; therefore, it appears that the facility currently has enough storage capacity to manage wastewater volumes produced during the NGS.

4.1.3 Runoff Restrictions

Section E of the permit contains a general prohibition against any runoff from any site or field used for wastewater reuse to any property not owned by Darling, except after a 25-year, 24-hour storm event or

greater. This storm event is to be defined by use of the Western Regional Climate Center (WRCC) Precipitation Frequency Map, Figure 28 "Isopluvials of a 25-YR, 24-HR Precipitation". For the Darling site, the 25-year, 24-hour event is 1.8 inches.

Although this permit condition did not appear in the previous permit for this site, DEQ notes that the North Indian Creek drainage channel runs directly along the northern and eastern boundaries of Field 1, and must be protected from any wastewater runoff from the site. Consequently, DEQ has inserted the runoff prohibition into the renewal permit. Although the existing berm structures erected onsite, along with a low likelihood of wastewater transport into surface waters during normal conditions (i.e., North Indian Creek is typically a dry drainage channel), appear to be sufficient to prevent runoff under normal conditions, DEQ recommends that the existing berm structures be evaluated to ensure that they will contain the runoff generated during a 25-year, 24-hour storm event.

4.1.4 Grazing Management Plan Requirement

The renewal permit requires submittal of a Grazing Management Plan, to be reviewed and approved by DEQ prior to initiation of any grazing activities onsite. Although the facility has indicated that there are currently no plans to implement such activities, DEQ has inserted this permit provision to allow ongoing regulatory oversight of any future modifications to the land application system and associated operations.

4.1.5 Allowable Crop Restriction

The renewal permit does not allow any crops for direct human consumption to be grown onsite. This permit condition was contained in the previous permit for the Darling facility and has been carried over into the renewal permit.

4.1.6 Ground Water Quality Restriction

The following language appears under the Ground Water Quality Requirement within the renewal permit:

> "Wastewater land application activities conducted by the permittee shall not cause a violation of the *Ground Water Quality Rule* (GWQR), IDAPA 58.01.11."

The previous permit for the facility required that down gradient monitoring wells meet the GWQR; however, this language has been replaced because of the impracticality of complying and/or enforcing this rather broad permit provision (e.g., sources outside the control of Darling may cause these wells to exceed GWQR standards). The revised permit language specifically pertains to wastewater land application activities conducted by Darling, and is intended to assure that the facility's wastewater treatment operations comply with the GWQR.

4.1.7 Maximum Chemical Oxygen Demand Loading Rate Limit

The previous permit for the facility established a maximum chemical oxygen demand (COD) loading rate limit of 1500 pounds per acre per month (lb/acre-month). While this limit is based upon a monthly averaging period, it essentially reflects the same mass loading rate limit recommended within the current WRP guidance (i.e., a COD loading rate limit of 50 lb/acre-day, based on a seasonal average for each GS). In an effort to update the facility's permit, the COD loading rate limit contained in the renewal permit has been changed to specify the recommended daily mass loading rate and averaging period. The 2004 application materials indicate that there is little daily variation in the wastewater

generation rate; therefore, altering the averaging period of the limit is not expected to reduce the environmental protection provided by this permit limit.

The 2004 application materials submitted by Darling indicate that COD loading rates could potentially range from 6.4 to 13.8 lbs/acre-day, although DEQ notes that actual loading rates in recent years have been much lower (i.e., refer to Table 3.3). Consequently, it appears that DEQ's guideline GS COD loading rate limit will provide more than sufficient loading capacity for the facility to treat its wastewater.

4.1.8 Maximum Nitrogen Loading Rate Limit

The previous permit for the facility established a maximum nitrogen loading rate of 150% of the previous 3-year average nitrogen removal rate of the crops grown onsite. This loading rate limit is the same as that typically recommended in the current WRP guidance (i.e., crop uptake plus 50%, with each year's uptake to be based on the previous 3-year average uptake).

Although this provision of the renewal permit has not been substantively changed from the previous permit requirement, DEQ notes that the nitrogen loading rate to Field 2 should be closely monitored to assure that ground water nitrate concentrations do not become excessive. As was noted in Section 3 of this document, Field 1 was historically overloaded with wastewater prior to use of Field 2. Implementation of wastewater application operations on Field 2 does appear to have relieved much of the historic overloading on the original site, as soil nitrate concentrations on Field 1 have decreased sharply since 2000. However, the soil nitrate concentrations on Field 2 have risen rapidly over this same time period, especially at lower soil depths (i.e., 12-36 inches below the surface). This trend appears to indicate that Field 2 may be receiving an excessive amount of nitrogen, which may eventually induce nitrate leaching into ground water. DEQ notes that the past three annual reports submitted by Darling appear to indicate that more wastewater has progressively been applied per acre on Field 2 each year, when compared to the amount of wastewater per acre applied on Field 1. In 2005, the wastewater applied per acre on Field 2 was approximately twice the amount applied on Field 1.

While DEQ recognizes that applying less wastewater on Field 1 may help to correct the impacts of previous operations, it is important that Field 2 does not become overloaded as a result. At the present time, ground water samples do not appear to exhibit any excessive nitrate concentrations, or any distinct increasing trend in nitrate concentration; however, this situation must be closely monitored by the facility and DEQ to assure that wastewater application rates do not result in adverse impacts to ground water in the future.

4.1.9 Maximum Total Dissolved Solids Loading Rate Limit

Dissolved solids loading rate limits are generally based upon either ground water or surface water concerns. Ground water samples from this site are consistently elevated and have included some exceedences of the GWQR standard for TDS; however, as was discussed in Section 3 of this document, the estimated crop TDS uptake rate appears to exceed current TDS loading rates from wastewater land application operations. Additionally, high TDS concentrations have been noted in Darling's up gradient monitoring well, which may be indicative of other external TDS sources.

Consequently, although ground water TDS concentrations remain elevated in this area, it does not appear that a dissolved solids loading rate limit for Darling will alleviate this issue. No NVDS or total dissolved inorganic solids (TDIS) loading rate limits have been incorporated into the renewal permit at this time. However, a re-opener clause is included in the event DEQ determines that this issue must be revisited at a later time.

4.1.10 Maximum Phosphorus Loading Rate Limit

No phosphorus loading limits are included in the renewal permit. However, a re-opener clause is included in the event DEQ determines that this issue must be revisited at a later time. Phosphorus loading rates are usually set by DEQ based upon either ground water or surface water concerns. With respect to ground water concerns, DEQ typically does not set a phosphorus loading limit where there is no direct interconnection between ground water and surface water (i.e. where ground water discharging from the down-gradient boundary of the treatment site does not enter surface water).

As was shown in Table 3.5, Field 1 has high soil phosphorus levels while Field 2 has much lower concentrations. Phosphorus can be a surface water concern if phosphorus bearing soils are subject to erosion and movement of sediments to surface water is possible; however, the runoff restrictions in the renewal permit (i.e., refer to Section 4.1.3 of this document for a discussion of these permit provisions) should substantially prevent phosphorous from entering surface waters near the land application sites at the present time. Additionally, DEQ has established a new ground water monitoring requirement for phosphorus in Section F of the renewal permit, which will allow more a precise evaluation for phosphorus impacts in the future.

There is concern that phosphorus in surface soils may runoff after site closure (i.e., ceases to be used for wastewater land treatment). In the event of any site closure during the term of the renewal permit, submittal of a closure plan is required under Section J of the permit. This closure plan should address soil phosphorus runoff as part of the site closure process.

4.1.11 Construction Plan Submittal Requirements

The WRP requires Darling to submit plans and specification for DEQ review and approval, prior to construction or modification of any wastewater facilities associated with the land application system. This is intended to allow ongoing regulatory oversight of any future modifications to the land application system and associated operations.

4.1.12 Buffer Zones and Wellhead Protection Restrictions

As part of the permit application renewal process, Darling requested that DEQ re-evaluate the buffer zones required for its wastewater land application sites. During development of the facility's existing permit (i.e., WLAP No. LA-000054-02), DEQ increased the buffer zone distances required between each HMU and public access and dwellings. The increased distances required for public access buffers resulted in the loss of approximately 2 acres of Field 1 that had previously been used for wastewater land application under the previous WLAP permit (i.e., WLAP No. LA-000054-01). The increased buffer zone requirements were based upon an informal, generalized buffer zone assessment (i.e., refer to page 3 of the staff analysis for Permit No. LA-000054-02) that was considered to be appropriate methodology at that time; however, since that time, DEQ has developed a more formalized method for assessing buffer zone distances. Although the newer methodology has not been widely implemented in DEQ's WRP Program at the present time, the methodology utilizes conventional fate and transport modeling in conjunction with standard microbial risk assessment methodology and is thought to provide a more reliable, consistent assessment than previous methods employed. The results of the microbial risk assessment conducted for Darling's facility are documented in a memorandum dated March 14, 2007, from Rick Hardy and Jeff Fromm to Steve Ogle, and is available in DEQ's source files for the facility.

Based upon the microbial risk assessment, it appears that conventional buffer zones (i.e., as specified in the *Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater*) are sufficient for

Darling's land application sites. Consequently, the buffer zones specified in the renewal permit reflect the conventional buffer zones given in DEQ's guidance document.

It should be noted that the permit contains a reopener clause in the event that any new, inhabited dwelling are to be constructed in the immediate vicinity of the facility. This language was inserted to allow the buffer zones to be modified as necessary to mitigate any concerns that may arise as land-uses in this area change over time.

4.1.13 Posting Requirement

In order to prevent accidental or unintentional human exposure to wastewater, the renewal permit requires signs to be posted around the perimeter of the land application system and at the entrance of all access roads into the site. The signs shall state "Wastewater Reuse Area, No Trespassing", or equivalent.

4.1.14 Odor Management Requirements

Section E of the renewal permit contains a provision stating that land application facilities and other operations associated with the facility shall not create a public health hazard or nuisance conditions including odors. This provision also requires that the site shall be operated in accordance with the permittee's current Odor Management Plan.

DEQ notes that the previous permit did not explicitly contain an odor prevention requirement, although Compliance Activity No. CA-00054-06 did require submission of an Odor Management Plan. DEQ received the odor plan under cover of a letter dated December 30, 1999. DEQ acknowledged the submittal in a letter dated January 24, 2000, although the plan was never officially approved by the agency.

Although DEQ acknowledges that the presence of some odors is inherent to the nature of operations carried out at the Darling facility, the agency also requires that nuisance odors must be controlled to the extent practical. Consequently, Section B of the renewal permit incorporates the current Odor Management Plan into the permit by reference, while Section G requires that the Odor Management Plan be reviewed, updated, and submitted to DEQ for approval. Refer to Section 4.4 of this document for a further discussion regarding the Odor Management Plan requirements contained in the permit.

4.1.15 Supplemental Irrigation Water Protection Requirement

This requirement mandates installation of a DEQ-approved backflow prevention device, where fresh and wastewater interconnections exist in the land application systems, to prevent contamination of the fresh irrigation water source (i.e., ground water, in this case). This is intended to assist with ongoing regulatory oversight of any future modifications to the land application system and/or associated operations.

4.1.16 Waste Solids Management Plan Requirement

Provision No. 5 in Section I of the renewal permit generally requires that management of waste solids is to be governed by the terms of a DEQ-approved waste solids management plan.

It should be noted that Darling submitted a Sludge Management Plan to DEQ on September 25, 2000, and proposed to land apply sludge dredged from the treatment ponds to permitted HMUs. This plan was never approved by DEQ, and the proposal to land apply the sludge was tentatively denied in a letter from DEQ dated April 18, 2005. Consequently, Darling has temporarily stored the dredge material in a

closed brine evaporation pond (formerly Brine Lagoon No. 2). In verbal communications with facility personnel during development of the renewal permit, it was indicated that a revised management plan for the sludge is currently in development, although the permit has been prepared prior to submission of this revised plan. Consequently, management of the sludge is being addressed as a compliance activity in the renewal permit. Refer to Section 4.4 of this document for further discussion.

4.1.17 Water Rights Requirement

Since this facility's land application operation requires significant irrigation water to successfully grow crops onsite (refer to discussion in Section 4.1.1 of this document), the previous permit required that water rights, sufficient to sustain the crops, be obtained prior to application of wastewater. This permit condition also appears in the renewal permit for the facility.

4.2 Monitoring Requirements – Section F

The monitoring provisions needed to assess and/or establish ongoing compliance with site-specific permit requirements are given in the following sections of this memorandum.

4.2.1 Total Volumetric Flowrate Measurement Requirement – Lift Station/Daily Parameter

As was discussed in Section 3 of this document, there has been some uncertainty regarding the annual wastewater generation rate, as well as wastewater influent rates and storage within the lagoon system. This issue is of concern because DEQ must be able to account for wastewaters generated and treated at the facility. Storage capacity in the lagoons is of importance because the lagoon system is used to hold wastewaters generated over the NGS. To assure that wastewater flows are properly monitored, the renewal permit now requires Darling to monitor the influent rate to the lagoon system. The monitoring point is the lift station to the lagoons, and the requirement specifies a daily basis to be consistent with the daily monitoring requirement for wastewater to each HMU.

4.2.2 Total Volumetric Flowrate Measurement Requirement – Wastewater Discharge/Daily Parameter

Darling must monitor and record the wastewater loading rate on each HMU to assess compliance with certain loading rate limits in the permit. For example, the total volume of wastewater applied to each HMU must be monitored to allow quantification of individual hydraulic and constituent loading rates for each HMU. This monitoring requirement specifies a daily recording basis and the wastewater discharge point to land as the monitoring point, which are the same parameters used in the previous permit.

4.2.3 Total Volumetric Flowrate Measurement Requirement – Irrigation Well/Daily Parameter

Darling must monitor and record the total hydraulic load each year to assess compliance with the GS hydraulic loading rate in the permit. This monitoring requirement specifies a daily recording basis and irrigation well as the monitoring point, which are the same parameters used in the previous permit. The irrigation wellhead is equipped with a flowmeter that is used to measure irrigation water flow.

4.2.4 Irrigation Water Calculation Requirement – Each HMU/Monthly Parameter, GS Only

The renewal permit contains a new permit condition that requires that Darling calculate the IWR for each crop type, on each HMU, and on a monthly basis. This provision was implemented in an effort to ensure that proper crop management techniques are used on the HMUs.

4.2.5 Wastewater Constituent Monitoring Requirements – Wastewater Discharge/Monthly Parameter

The renewal permit requires Darling to collect wastewater samples on a monthly basis. This condition is similar to the previous permit provision for wastewater monitoring, although the renewal permit no longer requires monthly monitoring of total coliform, as this requirement has been changed to a one-year/quarterly parameter (i.e., refer to discussion in the next section of this document). Additionally, the renewal permit no longer requires monthly monitoring of TDS or volatile dissolved solids (VDS), as is discussed under Section 4.2.7 of this document.

4.2.6 Wastewater Pathogen Monitoring Requirements – Wastewater Discharge/Quarterly Parameter, First Year Only

The previous permit for this facility required Darling to monitor total coliform in the wastewater effluent on a monthly basis. Although this data is of limited value due to the wide variations in reported results from month to month, the tests have indicated the presence of high total coliform counts in 2005.

In an effort to better characterize the wastewater effluent that is land applied, DEQ has deleted the previous monthly requirement for total coliform count, and is now requiring a series of analyses for specific pathogenic species, including total coliform, to be conducted quarterly for the first year of the permit cycle. Darling's process and wastewater characterizations have shown little variation over time, and it is expected that the results of this first-year monitoring will be sufficient to characterize wastewater over the entire 5-year cycle of the permit.

4.2.7 Wastewater TDS/VDS Monitoring Requirements – Wastewater Discharge/Quarterly Parameter, First Year Only

The previous permit for this facility required monthly sampling for TDS and VDS. These parameters could then be used to estimate and monitor the annual NVDS loading rate (i.e., TDS less VDS approximates the NVDS), which approximates the inorganic fraction of the TDS. The inorganic fraction is of particular interest when assessing the impacts of TDS loading to ground water. Due to the elevated TDS concentrations in ground water at this site, as well at the elevated SAR values discussed in Section 3 of this document, the renewal permit has been changed to specify monitoring of TDIS (i.e., refer to the next section of this document) because this parameter provides information for specific ion species present in the wastewater.

It should be noted that the renewal permit does require TDS and VDS to be monitored quarterly for the first year of the permit. When used in conjunction with the quarterly TDIS data collected during the same time period, the TDS/VDS data should establish a correlation between NVDS and TDIS. This correlation can then be used to estimate future NVDS loading rates, as needed, based upon the ongoing TDIS data collected.

4.2.8 Wastewater TDIS Monitoring Requirements – Wastewater Discharge/Quarterly Parameter

As previously stated, the renewal permit requires Darling to monitor TDIS concentrations in the wastewater on a quarterly basis. This permit condition did not appear in the previous permit for the facility, and has been included in the renewal permit in an effort to better characterize the nature of the TDS land applied at this site.

4.2.9 Ground Water Monitoring Requirements – Monitoring Wells/Biannual Parameter

The renewal permit requires Darling to pull ground water samples from dedicated monitoring wells twice per year. This monitoring requirement was contained in the previous permit for the facility,

although it must be noted that the renewal permit includes a new requirement to monitor total phosphorus concentration and no longer requires COD analyses. Additionally, it should be noted that the renewal permit now requires monitoring of ground water temperature and electroconductivity when collecting ground water samples, to ensure that representative samples are obtained.

4.2.10 Ground Water Analyte Monitoring Requirements – Monitoring Wells/Twice per Permit Cycle

This permit condition is intended to monitor baseline chemistry of commonly occurring ground water species. This monitoring requirement was also contained in the previous permit for the facility.

4.2.11 Soil Monitoring Requirements – Each Soil Management Unit/Annual Parameters

This permit condition is similar to the soil monitoring condition contained in the previous permit, although it should be noted that the renewal permit no longer requires Total Kjeldahl Nitrogen analyses and has added a requirement to measure the pH of the soils. Soil pH is used to determine the phosphorus test method to be used (i.e., the Olsen method or the Bray method).

4.2.12 Flow Measurement Calibration Requirement – Annual Parameters

This permit provision requires Darling to calibrate all flow meters and pumps used to directly or indirectly measure all wastewater and irrigation water flows applied to each HMU. This permit condition was not contained in the previous permit, and has been included to ensure accuracy in the monitoring data reported to DEQ.

4.2.13 Backflow Prevention Device Testing Requirement – Annual Parameter

This condition requires Darling to test all backflow prevention devices for all supplemental irrigation pumps directly connected to the wastewater distribution system. The testing date(s) and results of the test are parameters to be monitored and reported. If any test fails, the date of repair or replacement of the backflow prevention device, as well as a retest of the repaired/replaced device is required. This is a new condition of the renewal permit, and is ultimately intended to protect ground water quality at the site.

4.2.14 Seepage Testing Requirement – Each Holding Lagoon/Once per Permit Cycle

This permit provision requires Darling to conduct seepage rate testing on all wastewater treatment and/or holding ponds (i.e., currently Lagoon Nos. 1-5), as well as all active brine ponds (i.e., Brine Pond No. 3 at the present time). DEQ typically requires that wastewater ponds be tested in accordance with DEQ-approved methodologies, once per permit cycle. DEQ notes that Darling's previous seepage rate tests were conducted in 2004, and were approved in a letter from DEQ dated December 30, 2004; therefore, the permit requires the next round of tests sometime in 2009. This is a new condition of the renewal permit, and is also intended to protect ground water quality.

4.2.15 Seasonal Loading and Crop Assessment Requirements – Annual Parameters

These annual requirements require Darling to assess hydraulic and constituent loadings for each HMU. The facility is also required to report information regarding the performance of the crops grown on each HMU as part of the loading assessment. Although this permit provision is largely the same as that contained in the previous permit, Darling is now required to calculate the GS hydraulic loading rates for wastewater and irrigation water, the wastewater phosphorus loading rate, and plant uptake rates for phosphorus and ash.

4.3 Reporting Requirements – Section H

Section H of the permit contains the Annual Report requirements for the land application sites. Essentially, the Annual Report should contain results from all work conducted during the previous annual period for each monitoring requirement listed in Section F of the permit. This section also contains reporting requirements for all compliance activities contained in the permit.

4.4 Compliance Schedule for Required Activities – Section G

The following compliance activities have been implemented within the draft WRP in order to address various regulatory issues and/or update permit materials to reflect the current status of facility operations.

4.4.1 Updated Plan of Operation

The wastewater land application systems are currently operated under a Plan of Operation, dated April 14, 2000. As this plan is six years old, it should be reviewed and updated to reflect current permit limits and current operations at the site. Upon receiving DEQ's approval, the updated Odor Management Plan will be incorporated into the terms and conditions of the renewal permit, and will be enforceable as such (refer to Section B of the permit).

Additionally, the Plan of Operation is now required to contain a Contingency Plan addressing startup/shutdown operation(s), upset conditions, and emergency situations for the wastewater lagoons.

4.4.2 Updated Odor Management Plan

This facility has a history of odor complaints. A review of DEQ's WLAP files for this facility indicates that odor complaints related to land application operations at this facility peaked in 1998 and 1999. This time period coincides with the timeframe of the public comment period for the facility's existing WLAP permit (i.e., WLAP No. LA-000054-02, dated September 24, 1999). Several comments regarding odors were also received during a comment period for a more recent Air Quality (AQ) Permit-to-Construct (i.e., PTC No. 001-00108, dated April 25, 2002). Additional AQ-related odor complaints were also documented in 2002.

In light of these odor complaints, DEQ is requiring that the current odor Management Plan be updated and submitted for DEQ-approval. Darling submitted the current Odor Management Plan to DEQ for review on January 12, 2000. DEQ notes that the following activities, which may generate odors, are not covered in the current plan:

Startup/shut down of the aerators on Pond No. 3,
Temporary storage of dead stock, especially during hot weather periods, or
Scrubber malfunctions.

DEQ recommends that Darling consider methodologies and/or procedures to address these sources and/or events to minimize any associated odor events.

Upon receiving DEQ's approval, the updated Odor Management Plan will be incorporated into the terms and conditions of the renewal permit, and will be enforceable as such (refer to Section B of the permit).

4.4.3 Sludge Management Plan

As was previously discussed in Section 3 of this document, Darling submitted a Sludge Management Plan to DEQ on September 25, 2000, and proposed to land apply sludge dredged from the treatment

ponds to permitted HMUs. The proposal to land apply the sludge was tentatively denied in a letter from DEQ dated April 18, 2005. Consequently, Darling has temporarily stored the dredge material in a closed brine evaporation pond (formerly Brine Lagoon No. 2).

The renewal permit requires Darling to submit a revised Sludge Management Plan for DEQ review and approval. The plan must adequately characterize the waste solids and propose the manner in which the solids will be handled and disposed, sufficient to meet Condition No. 5 in Section I of the permit.

4.4.4 Renewal Permit Application

Compliance Activity No. CA-054-04 in the draft permit requires Darling to 1) meet with DEQ for a pre-application meeting, and 2) submit a permit application renewal package within six months of the permit's expiration date (i.e., to be documented in Section A of the permit upon final issuance).

5. RECOMMENDATIONS

Based on review of applicable state rules, staff recommends that DEQ issue draft WLAP Permit No. LA-000054-03 for a public review and comment period.